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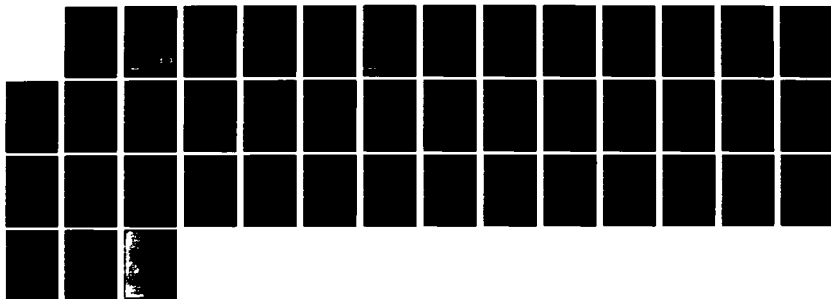
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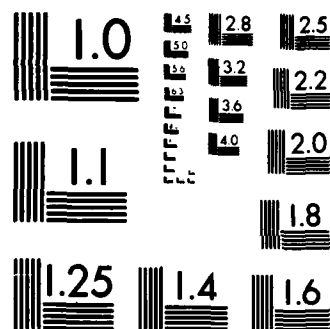
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A RAND NOTE

FOLLOW-UP OF PARTICIPANTS IN THE 1978 SELECTED RESERVE REENLISTMENT BONUS TEST

David W. Grissmer, John R. Hiller

February 1983

N-1880-NRAL

Prepared for

The Office of the Assistant Secretary
of Defense/Manpower, Reserve Affairs
and Logistics

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The research described in this report was sponsored by the Office of the Assistant Secretary of Defense/Manpower, Reserve Affairs and Logistics under Contract No. MDA903-80-C-0652.

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| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|--|-------------------------------------|---|
| 1. REPORT NUMBER N-1880-MRAL | 2. GOVT ACCESSION NO. AD-A127584 | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) Follow-Up of Participants in the 1978 Selected Reserve Reenlistment Bonus Test | | 5. TYPE OF REPORT & PERIOD COVERED Interim |
| | | 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) David W. Grissmer, John R. Hiller | | 8. CONTRACT OR GRANT NUMBER(s) MDA903-80-C-0652 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS The Rand Corporation 1700 Main Street Santa Monica, CA. 90406 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS Assistant Secretary of Defense Manpower, Reserve Affairs & Logistics Washington, D.C. 20301 | | 12. REPORT DATE February 1983 |
| | | 13. NUMBER OF PAGES 30 |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) | | 15. SECURITY CLASS. (of this report) UNCLASSIFIED |
| | | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |
| 16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; Distribution Unlimited | | |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) No Restrictions | | |
| 18. SUPPLEMENTARY NOTES | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Recruiting Bonuses Army Armed Forces Reserves | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) See Reverse Side | | |

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Describes the long-term results of national experiment designed to study factors that influence reenlistment decisions of Army Reserve and National Guard personnel. In the experiment, 15,000 reservists making reenlistment decisions in 1978 served as test participants. An original evaluation estimated the effect of bonus payments given for 3-year terms (\$900) or 6-year terms (\$1800) on reenlistment rates and length of commitment. This Note estimates the long-term effect of the bonus on reserve participation using longitudinal data collected 3-1/4 years after original reenlistment decisions. While the bonus only raised reenlistment rates from 38.4 to 40.6 percent, it significantly lengthened the average committed term of service from 1.3 to 4.4 years. Longitudinal tracking of test participants indicates a significant strength gain will result from the longer-term service commitments. After 3-1/4 years from the beginning of the test, the bonus group retained 32.0 percent of the original group, while the control group retained only 25.7 percent.

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PREFACE

The initial evaluation of the 1978 Selected Reserve Reenlistment Bonus Test indicated that the bonus raised retention rates only slightly, but lengthened the average term of commitment considerably. Since the bonus was initiated to help boost reserve strength, its effectiveness as an incentive will depend on whether the longer terms of commitment are translated into longer actual years of service. This Note describes the results of a follow-up of participants in the original test to determine their reserve participation status up to 3-1/4 years after the initial reenlistment decision. Thus, it provides a long-term evaluation of the effect of the bonus on actual manpower strength levels and, in addition, provides an estimate of the cost per additional man-year.

This Note was prepared as part of Rand's Manpower, Mobilization, and Readiness Program, sponsored by the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics)--OASD(MRA&L). It is the last of a series of five reports on the 1978 Reenlistment Bonus Test.

The first report, The Design, Administration, and Evaluation of the 1978 Selected Reserve Reenlistment Bonus Test, R-2865-MRAL, July 1982, evaluates the short-term effect of the bonus on the reenlistment rate and term of commitment. A Model of Reenlistment Decisions of Army National Guardsmen, R-2866-MRAL, October 1982, uses survey data collected during the test to develop a model that estimates the influence of reserve pay and other factors on reenlistment decisions. Data Bases for the 1979 Selected Reserve Bonus Reenlistment Test, N-1826-MRAL, forthcoming, provides the technical documentation for the data bases constructed during the test evaluation. The 1978 Selected Reserve Reenlistment Bonus Test: Executive Summary, R-2864-MRAL, April 1982, summarizes the test evaluation contained in R-2865 and R-2866. This Note provides the follow-up analysis.

SUMMARY

The advent of the All-Volunteer Force in 1973 raised concerns that the strength of the Selected Army Reserve components (Army Reserve and Army National Guard) would fall. That concern proved justified as the strength of the Army Selected Reserve components declined from 621,000 in FY 1973 to 544,000 in FY 1977. Although it was argued earlier that reserve strength could be maintained with specified pay raises, the manning levels still fell even when the recommended pay increases were exceeded.

The 1978 Army Selected Reserve Reenlistment Bonus Test was designed to determine the effects of bonuses in raising the reenlistment rate and lowering subsequent attrition rates. A group of over 5000 individuals in the Army Reserve and the National Guard was offered reenlistment bonuses of \$900 for a 3-year contract and \$1800 for a 6-year contract. This bonus group was matched with a control group that received no bonus offer. The experiment, which continued throughout calendar year 1978, included a total of more than 14,000 individuals in bonus and control groups.

Previous Rand studies analyzed the immediate effect of the bonus on reenlistment rates, choice of length of term, and the actual strength increase one year after the experiment ended. This study extends those results by analyzing participation behavior during the second and third years after the end of the experiment, by projecting that behavior through 7 years, and by estimating the incremental benefits and costs associated with the bonuses. Logistic regression models are used to estimate the bonus effects and to project future participation rates. (The regression models use probability of continued participation as the dependent variable.)

In the initial evaluation, the bonus group experienced roughly the same reenlistment rate (40.6 percent) as the control group (38.4 percent), although the difference was statistically significant. The bonuses added \$25 per month to reserve pay. While this increased net reserve pay (of bonus recipients) by 25 to 40 percent, it increased a

typical reservist's total income by only 2 percent. Thus, it is not surprising that few separation decisions were reversed, especially since a 3-year minimum commitment was required to obtain the bonus (1-year terms were allowed for nonbonus recipients). However, the bonuses induced those who already were willing to reenlist to accept longer terms. For example, 82 percent of the reenlisters in the bonus group signed up for 3- or 6-year terms; only 12 percent in the control group did so.

This study shows that the longer term of commitments results in increased man-years of service. The longitudinal data showed that the bonuses reduced the attrition rates during the second, third, and fourth years. The bonus group during those years declined to 38 percent, 33 percent, and 32 percent of the original group; the control group declined to 32 percent, 26 percent, and 25 percent of its original group. Projections indicated that roughly a 6-percentage-point difference will remain between the two groups until retirement.

Once we discovered how the continuation rates would change over time, we could estimate how many additional man-years were added as a result of the bonuses. Also, knowing how many reservists accepted the \$900 and the \$1800 bonuses, we could calculate the total bonus cost. Thus, we could estimate the cost per (additional) man-year.

Of course, the total benefits depend upon how long the retention-rate difference between bonus and nonbonus groups remains. For example, if one assumed that the rates remain different for only 7 years (the period for which projections were made), each additional man-year costs \$1040. However, the projections indicated that the difference in retention rates between the bonus and control groups was highly stable, allowing one to assume a longer benefit period. For example, if one assumes a 15-year flow of services (which would put many in the sample close to or beyond the 20-year point), the cost per additional man-year declines to \$450. In the latter case, the total bonus cost of 10,000 additional man-years over the 15-year period would be \$4.52 million.

Two qualifications of the cost estimates should be noted: First, one-half of the bonus was paid to an individual when he or she reenlisted; the remainder was drawn out in \$150 installments, paid at

the completion of each subsequent year of service. However, the incremental benefits of the program stretch out more evenly over time, lasting beyond the last bonus installment payment. Therefore, discounting the costs and benefits would yield a slightly larger man-year cost than the previous estimate.

Second, no alternative uses of the bonuses were considered, such as raising accessions instead of retentions, increasing base pay instead of offering bonuses, and other such alternatives. Thus, while this Note can evaluate the cost and effectiveness of the bonuses, it cannot make cost-effectiveness comparisons to other programs.

ACKNOWLEDGMENTS

The authors would like to thank Col. John R. Lilley II, USMC, former Director of Manpower, ODASD (Reserve Affairs), and John R. Brinkerhoff, former Acting Deputy Assistant Secretary of Defense, ODASD (Reserve Affairs). Lou Pales, Defense Manpower Data Center, created the analytical data set by merging the original bonus data with subsequent Reserve Master Files. Jane Sachar provided statistical estimations and helped draft an earlier version. Gene Rizer and James R. Hosek made numerous improvements through their technical reviews.

CONTENTS

| | |
|---|------|
| PREFACE | iii |
| SUMMARY | v |
| ACKNOWLEDGMENTS | ix |
| FIGURES AND TABLES | xiii |
| Section | |
| I. INTRODUCTION | 1 |
| II. REVIEW OF THE PREVIOUS TEST EVALUATION | 3 |
| Test Design | 3 |
| Results of First Evaluation | 5 |
| Reason for Follow-Up Evaluation | 9 |
| III. METHODOLOGY | 11 |
| Approach | 11 |
| Definition of Variables | 11 |
| Model Specification and Estimation | 12 |
| IV. RESULTS OF THE MODEL | 15 |
| V. BENEFITS AND COSTS OF THE BONUS | 21 |
| Estimates of Benefits | 21 |
| Estimates of Costs | 24 |
| Appendix A DEFINITION OF MEMBERSHIP VARIABLES | 27 |
| Third-Year Membership | 27 |
| Fourth-Year Membership | 27 |
| Appendix B DESCRIPTIVE STATISTICS | 31 |

CONTENTS

| | |
|---|------|
| PREFACE | iii |
| SUMMARY | v |
| ACKNOWLEDGMENTS | ix |
| FIGURES AND TABLES | xiii |
| Section | |
| I. INTRODUCTION | 1 |
| II. REVIEW OF THE PREVIOUS TEST EVALUATION | 3 |
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| V. BENEFITS AND COSTS OF THE BONUS | 21 |
| Estimates of Benefits | 21 |
| Estimates of Costs | 24 |
| Appendix A DEFINITION OF MEMBERSHIP VARIABLES | 27 |
| Third-Year Membership | 27 |
| Fourth-Year Membership | 27 |
| Appendix B DESCRIPTIVE STATISTICS | 31 |

FIGURES

| | | |
|----|--|----|
| 1. | Attrition of participants in the 1978 Bonus Test | 7 |
| 2. | Time plan for test and follow-up analysis | 10 |
| 3. | Percent of test groups remaining in service | 18 |

TABLES

| | | |
|-----|--|----|
| 1 | Distribution of Analytic Population in Bonus and Control Areas, by Component | 4 |
| 2 | Reenlistment and Term-of-Commitment Decisions for Reservists in the 1978 Bonus Test | 6 |
| 3 | Description of Variables | 13 |
| 4 | Regression Results | 16 |
| 5 | Membership Percentages and Continuation Rates | 19 |
| 6 | Actual and Projected Participation and Continuation Rates ... | 22 |
| 7 | Trend Lines for Participation Rates | 23 |
| 8 | Retention Equations | 24 |
| 9 | Comparison of Membership | 24 |
| A.1 | Codes for Defining Third-Year Membership | 28 |
| A.2 | Codes for Defining Fourth-Year Membership | 29 |
| B.1 | Unadjusted Participation Statistics | 32 |

I. INTRODUCTION

The 1978 Selected Reserve Reenlistment Bonus Test was undertaken as part of an effort to stop the precipitous decline in the strength of the Army Selected Reserve over the 1973-1977 period. The reserve components had shrunk from 621,000 in FY 1973, which marked the beginning of the All-Volunteer Force (AVF), to 544,000 in FY 1977.[1] That decline raised doubts about the viability of the Selected Reserve in an all-volunteer force.

Although the reserve depended heavily on draft-motivated personnel before the AVF, the Gates Commission predicted that Selected Reserve strength could be maintained close to pre-AVF levels with specified pay increases.[2] In fact, reserve pay was increased in excess of what had been proposed, yet manning levels still fell. The bonus test was designed to provide information about the decline and to discover what effects bonuses might have in reversing, or at least in stabilizing, the trend.

The 1978 Selected Reserve Reenlistment Bonus Test offered a bonus to reservists who had no prior service and fewer than 8 years of reserve service and faced a reenlistment decision in 1978. Ordinarily, the main effect of a reenlistment bonus is to increase strength by simply raising reenlistment rates. However, the reserve bonus offer was coupled with a requirement to accept a longer term of commitment. Bonus recipients had to accept either 3- or 6-year commitments, whereas nonbonus recipients could sign up for a single year. This bonus design meant that the bonus could have both short-term and long-term effects on reserve manning.

The short-term measures would include reenlistment rates and length of initial commitment. However, length of initial commitment is not a good long-term evaluation measure since shorter commitments could later

[1] Official Guard and Reserve Manpower Strengths and Statistics, September 30, 1980.

[2] The Report of the President's Commission on an All-Volunteer Armed Force, U.S. Government Printing Office, Washington, D.C., 1970, Chapter 9, "Reserve."

be extended and longer commitments could be broken. To evaluate the long-term effects on reserve strength, longitudinal data on actual participation are necessary.

This Note reports results from longitudinal data collected up to 3-1/4 years after the original reenlistment decisions. It provides actual strength differences between bonus and control groups. From the data, we project strength gains due to the bonus over the career span of participants, and we estimate the costs of these gains. Because of the stable pattern in the attrition trends among test participants, we believe that these estimates provide an accurate long-term evaluation of the effect of the bonus, and we plan no further longitudinal data collection.

Our analysis indicates that the substantial differences in participation between bonus and control groups measured in the first-year follow-up continued through the third and fourth years of the Bonus Test. By the fourth year, estimates indicate a 25 percent increase in personnel strength due to the bonus offer. These estimates show that 25.7 percent of the control group and 32 percent of the bonus group were still members. As expected, the 3-year reenlistees in the bonus group declined more sharply in the fourth year than did the 3-year reenlistees in the control group. A similar effect is expected at the 6-year point, and this effect was estimated in making projections beyond that point. Since projections through the seventh year indicated a continuing and a substantial effect, the benefits due to the bonus are likely to extend until participants retire. The cost per additional man-year including only strength gains through 7 years is \$1040; including a 15-year benefit period (roughly until the group retires) gives \$450.

Section II of this report briefly describes the test design and reviews results of the earlier evaluations. Section III presents the longitudinal evaluation methodology and Section IV gives the results using actual participation as the evaluation measure. Section V combines estimates of the cost of the bonus program with estimates of long-term strength gains to develop an estimate of cost per additional man-year.

II. REVIEW OF THE PREVIOUS TEST EVALUATION

TEST DESIGN

The Army Reserve received \$2 million and the Army National Guard \$3 million to conduct the 1978 Selected Reserve Reenlistment Bonus Test. Bonuses were offered only to reservists with less than 8 years of service. These reservists were deciding whether to reenlist for the first time after an initial 3-year or 6-year term, or whether to reenlist for a second or third term. Although guardsmen and reservists could reenlist or extend for 1, 2, 3, or 6 years, bonuses were offered only for a reenlistment of 3 years (\$900) and 6 years (\$1800). Reenlistees were paid one-half of the bonus amount at the time of reenlistment and the remainder in \$150 installments at the completion of each year of satisfactory service during the term.

The bonus program sought to increase reserve strength by increasing reenlistment rates and lengthening the term of commitment of reservists. Before the bonus test, most reservists who did not separate extended their term for a single year. Thus, the short-term evaluation measures were reenlistment rate and average length of commitment. However, since length of commitment may not reflect actual years served, a longitudinal evaluation component which measures actual years served is necessary.

The accurate measurement of the effects of the bonus test on reenlistment rates, term of commitment, and actual years served required an experimental design in which bonus payments were given to part of the eligible reserve population (bonus population) but withheld from another part (control population). Bonus payments were offered in six National Guard states and four Army Reserve regions. For each of these, a matching state or region did not offer bonuses (see Table 1). The control regions were chosen to match the bonus region on the basis of estimates of past retention behavior and economic characteristics of the region.

Over 14,000 guardsmen and reservists took part in the bonus and control states and regions. Each participant reached the end of his term of service (ETS) in 1978. Researchers monitored the reenlistment

Table 1

DISTRIBUTION OF ANALYTIC POPULATION IN BONUS
AND CONTROL AREAS, BY COMPONENT

| Bonus Area | No. of Participants | Control Area | No. of Participants |
|---|------------------------|---|------------------------|
| United States Army National Guard | | | |
| Kansas | 641 | Iowa | 835 |
| New Jersey | 1081 | New York | 1660 |
| Michigan | 972 | Pennsylvania | 1733 |
| Georgia | 732 | North Carolina | 1084 |
| North Dakota | 277 | Idaho | 297 |
| Oregon | 639 | Washington | 432 |
| West Virginia ^a | 0 | South Carolina | 911 |
| Total | 4342 | Total | 6952 |
| United States Army Reserve | | | |
| 94th ARCOM ^b and 76th Training Division ^b Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont | 845 | 79th ARCOM ^b and 99th ARCOM ^b Pennsylvania Ohio West Virginia | 1748 |
| 96th ARCOM ^c Colorado Idaho Montana New Mexico Utah Wyoming | 478 | 89th ARCOM ^c Kansas North Dakota Nebraska South Dakota | 437 |
| 205 Infantry Brigade ^d Iowa Minnesota Wisconsin | 177 | 157 Infantry Brigade ^b Pennsylvania | 213 |
| 187 Infantry Brigade ^b Massachusetts | 121 | | |
| Total | 1621 | Total | 2398 |

^aWest Virginia withdrew before the test began.

^bPart of the First Army.

^cPart of the Sixth Army.

^dPart of the Fifth Army.

decisions of all 14,000 and asked each to complete a questionnaire at the time of the reenlistment decision.

The data collected during the experiment allowed two separate analyses. The first, more narrowly focused, simply compared behavior in bonus and control groups to determine the effects of the bonus on reenlistment rates, the choice of term of service, and attrition behavior one year following the test.[1]

The second analysis used survey data to estimate a model of the reenlistment decision. The survey collected data on the type of civilian job, the civilian job wage rate, hours of work, employer characteristics, personal and family characteristics, military history, and reserve pay. Thus, the model provided estimates of the effects of a broad range of variables on the reenlistment decision.[2]

RESULTS OF FIRST EVALUATION

The initial evaluation of the 1978 Bonus Test focused on three possible decisions that a bonus could affect: the decision to separate, the choice of reenlistment term, and retention in the year following the test. The results (see Table 2) showed that the offer of a bonus caused little change in reenlistment rates (40.6 percent in the bonus group and 38.4 percent in the control group). However, the bonus payments led to a substantial lengthening of the terms of commitment selected by individuals who reenlisted. Of the reservists who decided to reenlist, those in the bonus regions selected 3- and 6-year reenlistment terms much more frequently (82 percent) than those in control regions (12 percent). In the latter, individuals greatly preferred 1-year extensions.

Analyses of actual participation as of December 3, 1979, one year after the completion of the test, indicated that the bonus group dropped in membership from 40.6 to 37.3 percent of the original sample, while

[1] David W. Grissmer, Zahava D. Doering, Jane Sachar, The Design, Administration, and Evaluation of the 1978 Selected Reserve Reenlistment Bonus Test, R-2865-MRAL, July 1982.

[2] Burke K. Burright, David W. Grissmer, and Zahava D. Doering, A Model of Reenlistment Decisions of Army National Guardsmen, R-2866-MRAL, October 1982..

Table 2
REENLISTMENT AND TERM-OF-COMMITMENT DECISIONS
FOR RESERVISTS IN THE 1978 BONUS TEST

| Decision | Bonus Group(a) | | Control Group(a) | |
|------------------------|----------------|------------|------------------|------------|
| | Number | Percentage | Number | Percentage |
| Reenlistment | | | | |
| Separated | 3496 | 59.4 | 5134 | 61.6 |
| Reenlisted or extended | 2390 | 40.6 | 3201 | 38.4 |
| Total | 5886 | 100.0 | 8335 | 100.0 |
| Term of commitment | | | | |
| 1 year | 436 | 18.2 | 2801 | 87.5 |
| 3 years | 571 | 23.9 | 333 | 10.4 |
| 6 years | 1383 | 57.9 | 67 | 2.1 |
| Total | 2390 | 100.0 | 3201 | 100.0 |

(a) The numbers and percentages are adjusted for small differences in the composition of the bonus and control groups.

the control group dropped from 38.4 to 30.4 percent (see Fig. 1). Of those who originally chose to stay in the reserve, 91.9 percent of the bonus group and 79.2 percent of the control group remained until December 31, 1979. Thus, a major influence of the bonus was to reduce separation decisions by lengthening terms of commitment, at least in the first year following the test.

Before discussing the new results from follow-up data collected 2 and 2-1/4 years after the end of the experiment, it is useful to consider one explanation for earlier results. Two potential effects of the bonus were considered.

First, reservists might be more likely to reenlist if offered a bonus; therefore, the bonus group could experience a higher reenlistment rate during the test. However, the individual was eligible to receive the bonus only if he accepted a 3-year term (\$900) or a 6-year term

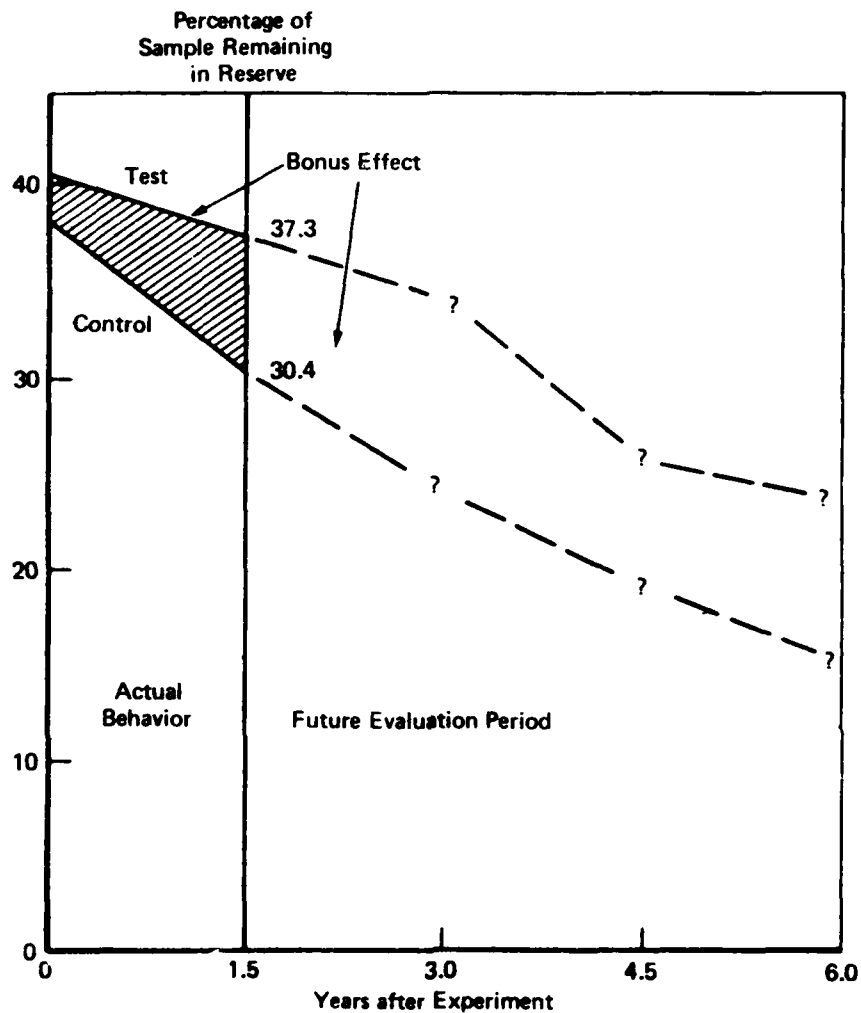


Fig. 1 -- Attrition of participants in the 1978 Bonus Test

(\$1800). While the bonus represents a 25 to 40 percent increase in reserve compensation, it adds only 2 percent to the typical reservist's annual income.[3] The results showed only a small increase in retention rates. One might argue that the bonus values of \$25 per month (which is the average over the bonus period) are not large enough to induce many persons to reenlist who would not otherwise have reenlisted, even though

[3] Ibid.

one-half the bonuses were paid immediately with \$150 paid in annual installments. Since a minimum 3-year term was required for the bonus, the \$25 per month would have to switch a decision from no reenlistment to a 3-year reenlistment. It was not surprising to discover the small reenlistment effect.

The second potential effect was to lengthen the chosen terms of people who would have reenlisted even without the bonus. Someone who would have extended for a year with no bonus might be induced to reenlist for 3 years with a bonus. Similarly, a 3-year reenlister might be willing to accept a 6-year contract for an additional bonus. Also, someone who would have signed up for 3 or 6 years might be more likely to serve out the entire term if he received a bonus. By this line of argument, the bonuses would keep persons in the reserve longer once they made their reenlistment commitment, but the bonuses would not necessarily affect the rate of reenlistment. In fact, the bonus did lengthen the terms of commitment substantially.

If an individual would extend one year for no bonus, then why would he not be willing to extend 3 years for a bonus, or 6 years for twice the bonus? What key influences affect that decision? If there were no opportunity costs in his life and if breaking a reserve contract were costless, he certainly would sign up for 6 years and obtain the larger bonus.

Since reservists may have substantial opportunity costs in their lives, generated by their jobs, families, and personal preferences, they may be unwilling to accept a longer-term commitment, especially if it is not easy or costless to break.[4] For bearing the risk and costs of the

[4] A term commitment is a legal obligation, and violation without an official discharge can result in being ordered to active duty. In practice, this rarely occurs, and there are extensive review procedures for obtaining discharges. While the type of discharge (dishonorable, general, honorable) may affect civilian job opportunities, its main effect probably is in determining eligibility for veteran benefits and return to reserve service. Thus, besides the termination of reserve pay and benefits, separation costs for the reservists include risk of losing eligibility for veteran benefits and not being able to return to reserve service. This risk can be nontrivial for those who may later want to achieve 20 years of service to qualify for a reserve retirement pension. An additional separation cost is incurred by reservists who accepted a bonus. They are required to return a pro rata share of the bonus if they terminate before they complete the initial commitment.

longer contract, they require compensation. Since a particular sample of reservists is likely to subsume a wide variety of perceptions of opportunity and separation costs, the distribution of sign-up periods is likely to reflect those perceptions. Opportunity costs and positive (perceived) separation costs can explain the distribution of terms of service chosen and the possible shift in the distribution as a result of the bonus.

REASON FOR FOLLOW-UP EVALUATION

The results of the follow-up to determine participation one year after the end of the experiment showed a significant gap between the bonus group (37.3) and the control group (30.4). This gap developed primarily because the longer terms of commitment induced a lower attrition rate in the test group. In the control group almost all reservists chose 1-year terms and had to make another reenlistment decision during this period. Given the opportunity to separate at their end of term of service (ETS), many did so.

However, this gap could easily disappear if those reservists who accepted bonus payments for 3- and 6-year terms register low reenlistment rates at the end of their term. In that case, the bonus would have simply delayed their leaving, and the effect would be felt only for up to 6 years. However, another possibility is that the gap would remain until the participants retired, thus creating a manpower strength increase over a much longer period. In this case, the bonus would have served to delay separation decisions until the influence of the retirement system induced a career decision.

The first point at which an assessment of the permanence of the gap can be assessed is 3 years after the initial decision. If the gap survives through the initial ETS decisions of those having 3-year terms, reasonable assumptions can be used to project the gap until retirement.

To confirm that longer reenlistment terms continued to result in increased participation, membership was assessed again as of December 31, 1980, two years after the completion of the bonus test. Test participants were in their third year following their reenlistment decision. In addition, membership as of March 31, 1981, was determined

for those in the first quarter of the 1978 Bonus Test year, which (as illustrated in Fig. 2) allows an analysis of membership in the fourth year. This is an important step because it provides a preliminary view of the reenlistment decision of those who had chosen a 3-year term.

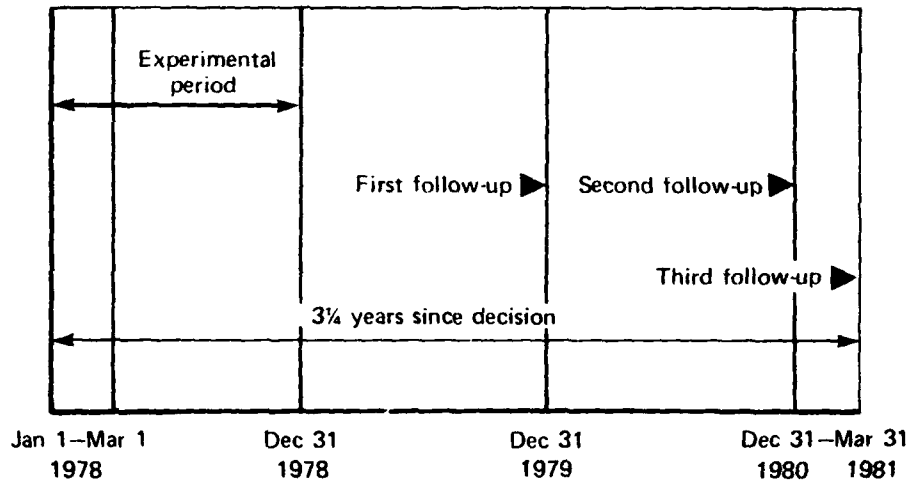


Fig. 2 -- Time plan for test and follow-up analysis

III. METHODOLOGY

APPROACH

Reservists were not assigned randomly to the bonus and control groups; therefore, any analysis of participation must account for a possible nonequivalence of the two groups before the test. A multivariate model of follow-up participation used to assess bonus effects as of December 31, 1979,[1] is again used to control for possible differences.

The model estimates the bonus effects and analyzes reserve participation in terms of individual and regional characteristics as of December 31, 1980, and March 31, 1981 (results for the earlier years are presented for comparison). Participation rates as of March 31, 1981, are analyzed only for reservists whose original decisions were made in the first quarter of the test year (1978). Because they had served 36 to 38 months since their original decisions, we were able to assess the reenlistment behavior of those who originally chose 3-year terms, then came up for another reenlistment and entered the fourth year after the test.

DEFINITION OF VARIABLES

The dependent variable in the model is dichotomous, indicating whether a member was a reservist (1) or not a reservist (0) as of a specified date. The experiment took place during the 1978 calendar year. Therefore, participation as of December 31, 1979, represented membership during the second year following the initial decision. (Of course, participation as of December 31, 1979, did imply participation for all individuals for all of the second year.) Similarly, participation as of December 31, 1980, implied membership during the third year. Further, participation in March 31, 1981 (for those who reenlisted in early 1978), implied entry into the fourth year after the

[1] David W. Grissmer, Zahava D. Doering, Jane Sachar, The Design, Administration, and Evaluation of the 1978 Selected Reserve Reenlistment Bonus Test, R-2865-MRAL, July 1982.

test. Also, it indicated a second reenlistment decision for reservists who chose a 3-year term. (The actual derivation of second-year membership is found in Grissmer et al.[2] The derivation of third- and fourth-year membership is presented in Appendix A.)

The independent variables used here are the same variables used in the previous test evaluations. Table 3 summarizes the definitions.

MODEL SPECIFICATION AND ESTIMATION

The maximum likelihood approach was used to estimate the coefficients (b's) in the following logistic model:

$$p = \frac{1}{1 + \exp[-(b_0 + b_1 X_1 + \sum_{i=2}^n b_n Y_n)]}$$

where p is the probability (bounded by 0 and 1) that an individual is a member at a particular point in time after the test, X_1 is the bonus dummy variable, the Y's are the independent variables describing the reservist's demographic characteristics, military experience, regional characteristics, and bonus group, and the b's are the estimated coefficients associated with each independent variable.

The results which follow present the multivariate analyses that correct for differences between the bonus and control populations that existed before the experiment. The unadjusted descriptive statistics that indicate roughly how participation rates differ between the bonus and the control groups are given in Appendix B.

[2] Ibid.

Table 3
DESCRIPTION OF VARIABLES

| Variable Name | Description | Codes | Definition |
|-----------------------|---------------------------------------|------------|---|
| Dependent Variables | | | |
| REENLIST | Decision to reenlist in 1978 | =0 =1 | Not reenlist Reenlist |
| SECOND YEAR | Membership as of December 31, 1979 | =0 =1 | Not member Member |
| THIRD YEAR | Membership as of December 31, 1980 | =0 =1 | Not member Member |
| FOURTH YEAR | Membership as of March 31, 1981 | =0 =1 | Not member Member |
| Experimental Variable | | | |
| BONUS GROUP | Bonus offered to group | =0 =1 | Control group Bonus group |
| Demographic Variables | | | |
| BIRTH YEAR | Year of birth | =XX | Year of birth (range = 1935-1958) |
| RACE | Race | =0 =1 | Nonblack Black |
| EDUCATION | Level of education | =0 =1 | High school graduate or less At least some college |
| DEPENDENTS | No. of dependents | =0-7 =8 | No. of dependents up to 7 8 or more dependents |
| MARRIED | Marital status | =0 =1 | Single Married |
| SEX | Sex | =0 =1 | Male Female |

Table 3 (continued)

Military Experience Variables

| | | | |
|----------------------------------|--|------|---|
| PAYGRADE | Pay grade | =1-7 | (E-1 to E-7) |
| DRAFT MOTIVATED | Motivation for recent enlistment | =0 | If reservist did not enlist in most recent term to avoid draft |
| | | =1 | If reservist enlisted to avoid draft |
| COMBAT MOS | Combat military occupational specialty (MOS) | =0 | Noncombat primary MOS |
| | | =1 | Combat primary MOS |
| FIRST-TERM MALE | First-term male | =0 | Reservist is not a first-term male |
| | | =1 | Reservist is a first-term male |
| INITIAL OBLIGATION 6 YEARS | Length of first term in reserve | =0 | Initial obligation was 3 years |
| | | =1 | Initial obligation was 6 years |
| RESERVE | Reserve or guard membership | =0 | National Guard |
| | | =1 | Army Reserve |
| FIRST TERM | First term of service during test | =0 | Current term was not first enlistment |
| | | =1 | Current term was first enlistment |

Regional Characteristics in Army Command or National Guard State

| | | | |
|-------------------|-------------------|---|----------------------------------|
| UNEMPLOYMENT | Unemployment rate | = | 1978 unemployment rate |
| PER CAPITA INCOME | Per capita income | = | Log of 1978 per capita income |

IV. RESULTS OF THE MODEL

To take account of the demographic, military, and regional differences of individuals in the bonus and control groups, the logistic regression model defined earlier was applied to third- and fourth-year membership. The model compared reservists who were members in the third year following the experiment with reservists who had separated by the third year; similarly, the model analyzed the fourth-year membership.

The results obtained for fourth-quarter membership are based on a subset of the full sample. Individuals who made decisions in the first quarter of 1978 approached the end of their third year by the first quarter of 1981. By March 1981, they had made decisions concerning their fourth year. This was an important decision point because those with 3-year commitments would have fulfilled the commitment and would face another decision.

Thus, a possible decline in the participation rate would occur as those who signed up for 3 years (in order to receive the bonus) would have an opportunity to leave without breaking their commitments. The drop in reenlistment rates would indicate to what extent reservists signed up for the 3-year period to receive the bonus. It also would suggest what sort of decline in continuation rates might occur after the 6-year point.

Table 4 presents the results of the follow-up for the third and fourth year and includes the prior regression estimates obtained for those in the first and second years of the tests.[1] The statistical performances of all models are quite good, as indicated by the likelihood ratios and the numerous highly significant variables. The

[1] In order to obtain results comparable to the earlier studies, the same regression models were estimated, a practice that created certain limitations. The model were not causally designed--i.e., based on an economic theory of the separation or term decision--but descriptively designed, attempting to estimate the effect of the bonus offer with numerous other variables held constant. A model based on theoretical grounds would have required more extensive data. Also, note that because of uncertainty in certain personnel records, the second-year sample was about 5 percent smaller than the full sample.

Table 4
REGRESSION RESULTS

| | Follow-up Membership | | | |
|-------------------------------|--------------------------------------|------------------------------|-----------------------------|------------------------------|
| | First Year (During Experiment) | Second Year (Dec 1979) | Third Year (Dec 1980) | Fourth Year (Mar 1981) |
| Constant | 9.45 | 12.11 | 9.12 | 7.83 |
| Bonus Group | .11(a) | .37(a) | .41(a) | .34(a) |
| Demographic | | | | |
| Birth year | -.04(a) | -.05(a) | -.04(a) | -.03 |
| Race | .39(a) | .40(a) | .38(a) | .41(b) |
| Education | -.21(a) | -.24(a) | -.19(a) | -.14 |
| Dependents | .09(a) | .09(a) | .09(a) | .04 |
| Married | -.12(b) | -.05 | -.09 | -.24(b) |
| Sex | .05 | -.08 | -.01 | -.19 |
| Military Experience | | | | |
| Pay grade | .47(a) | .45(a) | .42(a) | .51(a) |
| Draft motivated | -.72(a) | -.81(a) | -.84(a) | -.55(a) |
| Combat MOS | -.19(a) | -.19(a) | -.18(a) | -.09 |
| First-term male | -.45(a) | -.44(a) | -.35(a) | -.24 |
| Initial obligation 6 years | -.33(a) | -.56(a) | -.41(a) | -.75(a) |
| Reserve | .12(a) | .08 | .07 | .22(b) |
| First term | -.13 | -.10 | -.12 | -.45 |
| Regional Characteristics | | | | |
| Unemployment | .08(a) | .10(a) | .09(a) | .04 |
| Per capita income | -1.06(a) | -1.36(a) | -1.07(a) | -1.01 |
| N | 14221 | 13521 | 14221 | 3013 |
| Log likelihood ratio | 1184(c) | 1167(c) | 1017(c) | 185(a) |
| Means | | | | |
| Bonus | .406 | .373 | .331 | .32 |
| Control | .384 | .304 | .258 | .257 |

(a) Significant at 1 percent.

(b) Significant at 5 percent.

(c) Significant at .1 percent.

initial finding of the models is that individuals in the bonus group have a significantly greater probability of remaining in the service from the first through the fourth year after the start of the test. The earlier results hold up even when numerous other variables are taken into account. Also, the models show roughly the same coefficients and significance levels for each time period, with the fourth year results being somewhat weaker, perhaps since the sample is far smaller.

The regression equations can be used to estimate the difference in strength induced by the bonus.[2] These estimates show that during the year of the Bonus Test, 40.6 percent of the bonus group and 38.4 percent of the control group reenlisted. The results of the follow-ups done as of December 31, 1979, December 31, 1980, and March 31, 1981, are shown in Fig. 3.

The data show that the initial major strength difference occurred in the December 31, 1979, measurement. By this time, all reservists in the test who had reenlisted for a single year had made another reenlistment decision. The participation gap at this point mainly reflects the fact that 88 percent of the control group had one-year terms compared with 18 percent of the bonus group. A simple explanation for this gap is that the longer terms of service engendered by the bonus created higher separation costs than for one-year terms, and consequently attrition was lower in the bonus group.

The gap remained fairly stable between the December 1979 and December 1980 measurements. This indicated that attrition rates were approximately equal in the two groups during this period. For the bonus group, this measurement does not yet capture the effect of the reenlistment decision of those who chose 3-year terms. Thus, the attrition in the test group through this period mainly reflects non-ETS attrition (often caused by geographical relocation). For the

[2] To make this estimate, we evaluated the logistic function twice for each individual, first with the bonus variable equal to one, and second with the bonus variable equal to zero. Our estimate of the reenlistment rate in each case was derived by taking the mean of the function values for all individuals in the sample.

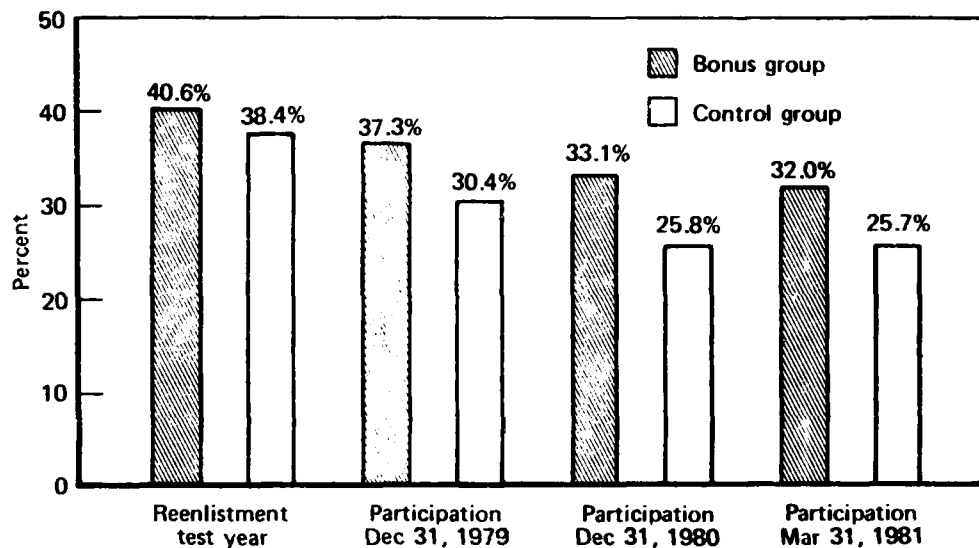


Fig. 3 — Percent of test groups remaining in service

control group, the attrition through this period represents non-ETS attrition and the subsequent reenlistment decisions of those who originally chose 1-year terms.

The first real indication of the permanence of the strength difference comes with the March 1981 measurement. This measurement tracked only reservists who had reenlisted during the first quarter of the test (January-March 1978). It thus captures the decisions of bonus group participants who chose 3-year terms.

Table 5 summarizes the results, showing the percentages of the original groups remaining in the service, and the continuation rates (the percentages of the previous year's groups remaining in the service). Although the bonus group is still larger during the fourth year, the continuation rate for the sample entering the fourth year is lower than for the control group as a result of 3-year reenlistees serving out their contract periods and then separating. However, as Table 5 indicates, the gap between test and control group narrowed only slightly as a result of these decisions.

Table 5
MEMBERSHIP PERCENTAGES AND CONTINUATION RATES (a)

| Time | Participation Percentages | | Continuation Rates | |
|-------------------|---------------------------|-------|--------------------|-------|
| | Control | Bonus | Control | Bonus |
| During experiment | 38.4 | 40.6 | -- | -- |
| Second year | 30.4 | 37.3 | 79.2 | 91.9 |
| Third year | 25.8 | 33.1 | 84.9 | 88.7 |
| Fourth year(b) | 25.7 | 32.0 | 95.2 | 92.0 |

(a) The participation percentage is the percentage of members of the original bonus and control groups remaining in the service. The continuation rate is the percentage of the previous year's group remaining in the service.

(b) The fourth-year percentages are based on the first-quarter sample.

The regression results suggest several other conclusions regarding attrition behavior.

- o Greater unemployment and lower per capita income are associated with greater retention, implying that economic circumstances affect retention decision.
- o Higher grades are associated with higher retention rates, while draft-motivation, combat military occupational specialty, longer first terms of service, and the combination of first-term and male are associated with shorter terms.
- o During the experiment and during the fourth year, Army reservists had higher retention than National Guardsmen.
- o A younger age, less education, a black race status, and fewer dependents are demographic factors related to higher retention.

- o The male-female distinction alone made no difference (although colinearity with other variables does not allow a definitive conclusion).
- o Marital status was important only during the first and fourth years of the experiment, when married people had lower retention rates.

One could suggest numerous explanations for the above findings, but since the models were developed only as descriptive tools, the relationships may not reflect causative factors. The unemployment and per capita income variables are the closest to suggesting causal relationships.

V. BENEFITS AND COSTS OF THE BONUS

This section estimates the gain in man-years per dollar expended by the bonus experiment. The benefits of the reenlistment bonus result from the gap in manpower strength of the bonus and control groups. The service obtains a greater flow of manpower over time, implying that the program benefits must be defined in man-years and the cumulative effect of the benefits over time must be accounted for. The costs of the program also occur over time and they are expressed in dollars expended.

Since the benefits will exist over a long period, it is necessary to extrapolate from our current data to estimate these benefits. However, since the gap has remained relatively stable over the first 4 years of experience, the estimates--though preliminary--provide a reasonably accurate picture of the cost-effectiveness of the bonus program.

ESTIMATES OF BENEFITS

Table 5 of the preceding section illustrated the actual behavior of the individuals in the bonus and control groups through a 4-year period. Using the logistic regression models and some assumptions concerning future continuation rates, it was possible to project the behavior through several more years.

Table 6 presents the earlier data and shows the projections through the seventh year. The key assumptions were that the continuation rate of 95.2 percent would remain constant for both groups except for the seventh year in the bonus group, where a lower value of 92.0 (similar to the fourth year) reflects the lower subsequent reenlistment rates of 6-year enlistees.

The high continuation rates for later years appear to be a reasonable assumption because of the pull of retirement benefits. Seven years after the reenlistment test, the participants would have served between 13 and 15 years. At that point, retirement benefits are the predominant incentive; a reservist who has remained in the service (whether or not he received a bonus) may be likely to stay on through

Table 6
ACTUAL AND PROJECTED PARTICIPATION AND CONTINUATION RATES

| Time | Participation Percentages | | Continuation Rates | |
|-------------------|---------------------------|-------|--------------------|-------|
| | Control | Bonus | Control | Bonus |
| During experiment | 38.4 | 40.6 | -- | -- |
| Second year | 30.4 | 37.3 | 79.2 | 91.9 |
| Third year | 25.8 | 33.1 | 84.9 | 88.7 |
| Fourth year | 25.7 | 32.0 | 95.2 | 92.0 |
| Fifth year(a) | 24.5 | 30.4 | 95.2 | 95.2 |
| Sixth year(a) | 23.3 | 29.0 | 95.2 | 95.2 |
| Seventh year(a) | 22.2 | 27.7 | 95.2 | 92.0 |

(a) These values are projections based upon behavior during the first four years. The continuation rates were assumed to be constant, except for a drop-off at the end of the sixth year.

the retirement point. If that conclusion is correct, the bonus program may be of considerable value since the flow of added manpower services would continue until retirement.

The first step in determining the benefits of the bonus payments is to estimate the total flow of manpower services in each group, then to determine the year-by-year differences in participation between groups. The annual costs (bonuses) and benefits (man-years) then may be compared and discounted to the present value. (Of course, there may be benefits in addition to a greater number of man-years obtained, e.g., lower turbulence in units and possibly greater readiness and productivity.)

The participation rate profiles in Table 6 may be used to determine the total flow of services in each group. Once the analytic forms of the equations are known, the total man-years of service may be determined by solving for the areas under the curves. In summary, one

must estimate the participation rate curves, calculate total flows of man-years, and compute annual differences between the groups. The result is the increased man-years of service for each year (going out to seven years in this case) caused by the bonus payments.

The participation data suggest that a point of discontinuity exists in the third year. Therefore, for each group, one trend line is fitted (by ordinary least squares) for the years one through three, then a second line is fitted for years three through seven. Table 7 displays the estimated regressions.

The number of individuals remaining in the cohort during year, $N(t)$, is equal to the initial number of individuals in the group reenlistment, $N(0)$, times the participation, $PR(Y)$, where $Y(t)$ denotes year t . Mathematically, one may write,

$$N(t) = N(0) \times PR[Y(t)].$$

Assume, for example, that 1000 people are in each group. The equations describing the number of reservists still in the service at time t are illustrated in Table 8.

Table 9 summarizes the year-by-year gains obtained by the bonus, assuming groups of 1000 reservists at reenlistment. The total gain over 7 years is 490 man-years. The average of the annual percentage gains is 27.8 percent.

Table 7

TREND LINES FOR PARTICIPATION RATES (a)

| | Years 1-3 | Years 3-7 |
|---------------|-------------------|-------------------|
| Bonus group | $PR = .45 - .04Y$ | $PR = .37 - .01Y$ |
| Control group | $PR = .44 - .06Y$ | $PR = .29 - .01Y$ |

(a) PR = participation rate and $Y = 1, 2, \dots, 7$. The R-squared values are 0.95 or above for all equations.

Table 8
RETENTION EQUATIONS

| | Years 1-3(a) | Years 3-7 |
|---------------|-------------------|-------------------|
| Bonus group | $N(t)=450-40Y(t)$ | $N(t)=370-10Y(t)$ |
| Control group | $N(t)=440-60Y(t)$ | $N(t)=290-10Y(t)$ |

(a) $N(t)$ = number of people in service during year t ; $Y(t)$ = year. It is assumed that 1000 reservists came up for reenlistment in year 0, and 450 and 440 actually reenlisted in the bonus and control groups.

Table 9
COMPARISON OF MEMBERSHIP

| Year | Bonus Group | Control Group | Gain |
|------|-------------|---------------|------|
| 1 | 410 | 380 | 30 |
| 2 | 370 | 320 | 50 |
| 3 | 340 | 260 | 90 |
| 4 | 330 | 250 | 80 |
| 5 | 320 | 240 | 80 |
| 6 | 310 | 230 | 80 |
| 7 | 300 | 220 | 80 |

ESTIMATES OF COSTS

Prior analyses indicated that 40.6 percent of the bonus group reenlisted, but only 33.2 percent of the original group accepted a bonus. Those accepting \$1800 constituted 23.5 percent of the group and

those accepting \$900 constituted 9.7 percent. If there were 1000 reservists in the bonus group, 235 would choose \$1800 and 97 would choose \$900. However, since the payment schedule called for one-half of the bonus at the time of reenlistment, with \$150 at the end of each year, the total cost will vary with attrition rates. The formula used to calculate total costs for our sample of 1000 is

$$C = (235)\left(\frac{1800}{2}\right) + \sum_{i=1}^6 (235)(150)(Pr) + (97)\left(\frac{900}{2}\right) + \sum_{i=1}^3 (97)(150)(Pr)$$

where Pr = percentage of group left in year r .

Using Pr calculated from Table 9, the total cost of the bonus per 1000 bonus participants is \$460,000. Table 9 estimated a gain of 490 man-years over the 7-year period, for a cost per man-year gain of \$940. (One would arrive at the same figure using the annualized cost and annualized man-year gains.) However, that estimate assumes that all benefits end after 7 years. The projection analyses suggested that the gain in man-years would remain constant over long periods.

Thus, if one assumes that the gain continues for 15 years, the cost per man-year becomes \$460,000/1130 man-years, which equals \$410 per man-year. For example, an increase of 10,000 man-years over the long run would cost \$4.1 million, the latter spread out over only 6 years. (If all costs and benefits were placed on a present value basis, a one man-year gain would be more expensive since the benefits are distant but the costs near.)

Appendix A

DEFINITION OF MEMBERSHIP VARIABLES

Three dependent variables were used in this study, representing membership during the second, third, and fourth years following the reenlistment decision in the experiment.

THIRD-YEAR MEMBERSHIP

Reserve Master Records were used to determine third-year membership (see Table A.1). The March 1981 Master File contains all members as of March 1981 and all transactions submitted on or before April 20, 1981. Records of all 14,221 reservists in the Bonus Test population were obtained. Matching was done by social security number. Reservists without a social security number match were considered nonmembers.

The components do not always submit timely transaction information. Delays of several months are commonplace. Therefore, transaction records received between January and June 1981 were also obtained. Included in the transaction record is the Transaction Effective Date (TED). To determine membership as of December 1980, 155 corrections to the original records were made for all transactions with a TED on or before March 31, 1981. Transactions with a TED on or before December 1980 were differentiated from those between January and March 1981.

The transaction codes show a gain (G), loss (L), Reenlistment or Extension (M), or no code (b). The following scheme was used for Master Record conversions to determine membership as of December 1980. Third-year membership was coded (1) for member and (0) for nonmember.

FOURTH-YEAR MEMBERSHIP

All Bonus Test participants with an initial ETS between January and March 1978 were into the fourth year by March 1981. Therefore, fourth-year membership also was determined. Corrections to the March 1981 Master File were made for the 57 transactions with a TED on or before March 31, 1981, using the scheme shown in Table A.2.

Table A.2

CODES FOR DEFINING FOURTH-YEAR MEMBERSHIP

| Presence on March 1981 Master File | Transaction Date before March 1981 | Fourth Year Membership | Number |
|---------------------------------------|---------------------------------------|---------------------------|--------|
| Yes | G,M | 1 | 30 |
| | L | 0 | 40 |
| | b | 1 | 3,955 |
| No | G,M | 1 | 17 |
| | L | 0 | 0 |
| | b | 0 | 10,179 |

Appendix B

DESCRIPTIVE STATISTICS

Table B.1 provides the unadjusted statistics for participation for the follow-ups in December 1979, December 1980, and March 1981. The statistics are tabulated for those who originally separated, and by term of commitment for those who reenlisted. The tabulation can be used to tentatively answer certain questions concerning the bonus offer.

Does the slower attrition for the bonus group reflect the fact that someone who received a bonus for a 3- or 6-year term is more likely to serve out the term than someone who signed up for the same period but without the bonus? The answer appears to be yes: If two individuals signed up for the same enlistment terms, the one who received a bonus is more likely to serve out the term than the other.

For example, consider all the reservists who signed up for a 6-year reenlistment term. The group that received a bonus offer declined to 93.2 percent during the second year and 81.1 percent the third. The group that did not receive the bonus offer shrank to 89.2 percent, then 73.6 percent during the same years. The attrition in the latter group was notably faster. Consider again those who signed up for a 3-year period. The bonus group fell to 90.5 percent, then 76.2 percent, while the control group declined 84.5 percent, then 72.9 percent. Again, the bonus effect is clear.

One additional piece of evidence strengthens the findings. Consider the individuals who signed up for only a 1-year extension. No one in the bonus group was eligible to receive a bonus unless he accepted a minimum 3-year reenlistment. Therefore, none of the 1-year extenders, in either group, received a bonus. Of that set of reservists in the bonus group, only 64.2 percent remained in the service during the second year, and only 45.0 percent during the third. For the control group, the percentages were 77.1 percent and 57.4 percent. The attrition in the bonus group was actually greater than for the equivalent reservists in the control group. Thus, it was not simply the reservist's presence in the bonus group, but acceptance of the bonus, that reduced the attrition rate.

Table B.1
UNADJUSTED PARTICIPATION STATISTICS

| Initial Decision | Control | | Bonus | | Difference |
|------------------------------------|---------|------|-------|------|------------|
| | n | % | n | % | |
| Membership as of December 31, 1979 | | | | | |
| Separate | 5024 | 4.6 | 3508 | 4.5 | -0.1 |
| 1 year | 2426 | 77.1 | 352 | 64.2 | -12.9 |
| 3 years | 315 | 84.5 | 525 | 90.5 | 6.0 |
| 6 years | 58 | 89.2 | 1313 | 93.2 | 7.0 |
| Total | 7823 | 31.0 | 5698 | 36.5 | 5.5 |
| Membership as of December 31, 1980 | | | | | |
| Separate | 5089 | 5.2 | 3546 | 5.2 | 0.0 |
| 1 year | 2844 | 57.4 | 431 | 45.0 | -12.4 |
| 3 years | 334 | 72.9 | 547 | 76.2 | 3.4 |
| 6 years | 68 | 73.6 | 1062 | 81.1 | 7.5 |
| Total | 8335 | 26.3 | 5886 | 32.3 | 6.0 |
| Membership as of March 31, 1980 | | | | | |
| Separate | 1059 | 4.7 | 685 | 4.1 | -0.6 |
| 1 year | 671 | 55.4 | 81 | 45.7 | -9.7 |
| 3 years | 68 | 64.7 | 129 | 59.7 | -5.0 |
| 6 years | 20 | 80.0 | 300 | 74.7 | -5.3 |
| Total | 1818 | 26.5 | 1195 | 30.6 | 4.1 |

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